

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2022-146

Anonymous Referee #1

Referee comment on "Performance and polarization response of slit homogenizers for the GeoCarb mission" by Sean Crowell et al., Atmos. Meas. Tech. Discuss.,
<https://doi.org/10.5194/amt-2022-146-RC1>, 2022

<General Comments>

Imaging spectrometer with high spectral resolution is a key technology for greenhouse gases and their related species monitoring by remote sensing. Acquired image provides large emission sources and plume information. Very narrow spectral width needs moderate optical throughput to achieve high signal to noise ratio. Inhomogeneity within the footprint distorts the instrument spectral response function (ISRF). Gratings are conventionally used, but they have high polarization. Measurement techniques acquiring solar lights reflected by the Earth's surface and scattered by thin cloud and aerosols should care input light polarization, too. The topics discussed here is challenging and important. My question is which is more critical for GeoCarb: polarization sensitivity or spatial inhomogeneity? Both OCO-2 and GeoCarb are using high resolution imaging spectrometer technology, but they have different swath, spectral coverage, and throughput, The OCO-2 and OCO-3 on orbit already achieved low bias and reduce random errors in CO₂ retrieval without using state-of-art slit homogenizer. Are there a critical angle and/or spectral band, and footprint size, where the distortion in ISRF becomes critical for CO₂ retrieval? What is the main difference between OCO-2 and GeoCarb?

Slit design, method, and results of characterization test in the laboratory are well described. I recommend minor revision before publication.

<Specific Comments>

(1) Page 4. MODIS data

If it is a real data, the location and date of the observation should be described.

(2) Page 10, Fig. 6 The right figure

Is "analyzer" a "polarizer" in the middle figure? Description of analyzer is needed.

(3) Page 10, Line 187 "noise"

Is it random electrical noise?

(4) Page 13, Figure 8, "different level of illumination"

More detailed explanation such as definition of "level", will help readers' understanding.

<Technical Corrections>

There are no specific comments.